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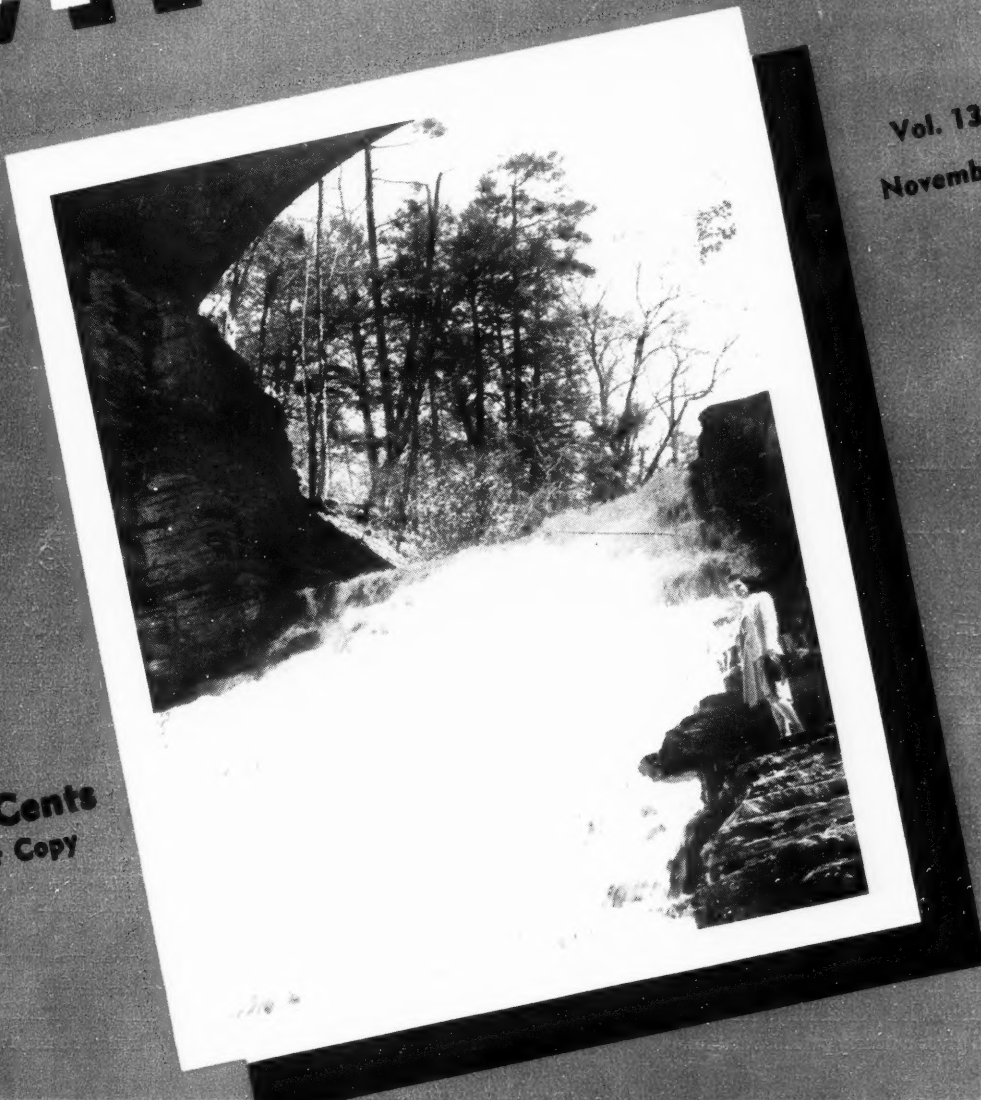

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The CORNELL ENGINEER

Volume 13 Number 2

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Cover: A co-ed gazes raptly as water from Cascadilla Creek tumbles over the Central Avenue Falls.

—B. A. L.

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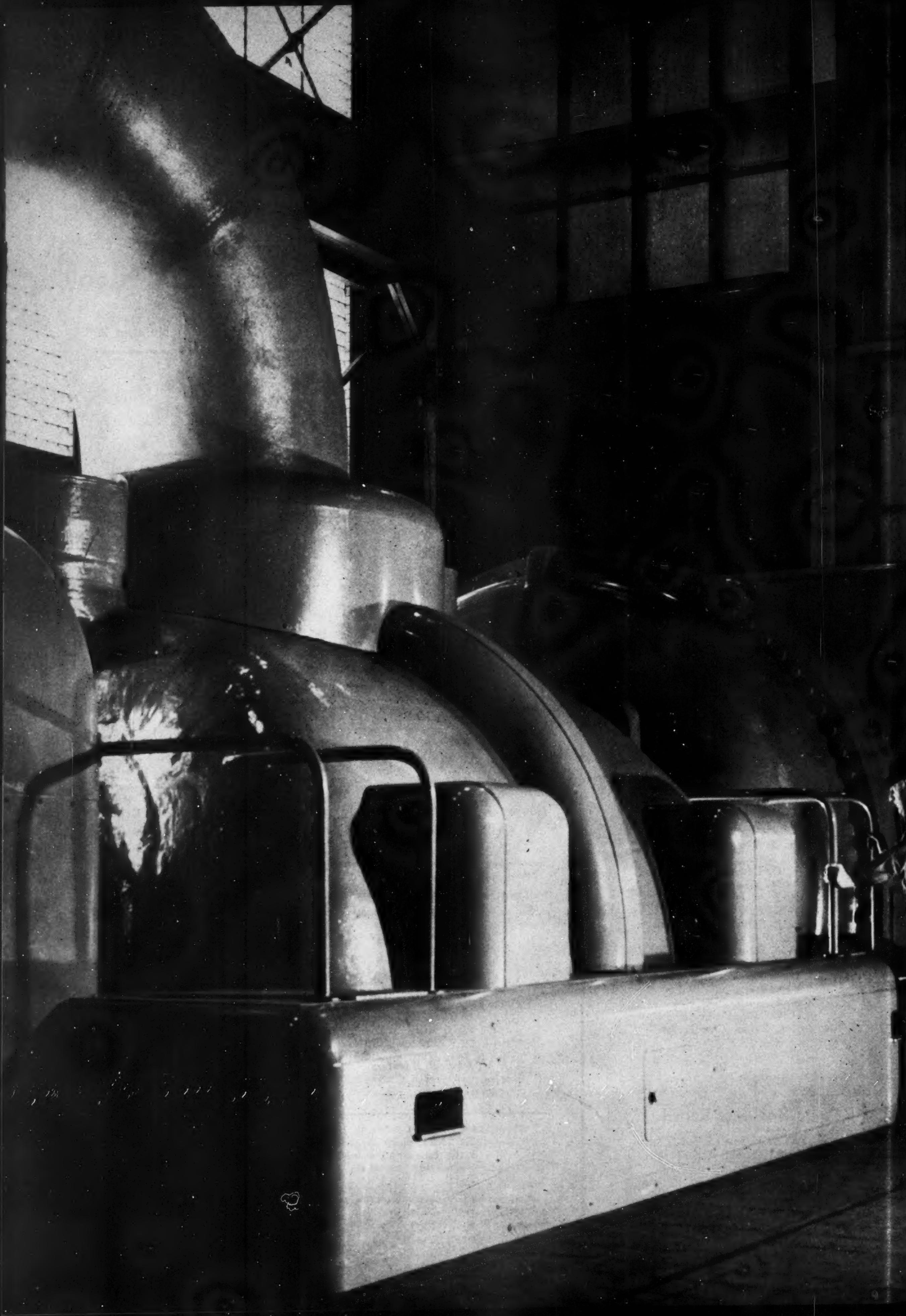

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Modern Method Of
Production Control

Manufacturing Progress Through Process Planning

By EDWARD A. REED

SINCE 1812, when Eli Whitney made his great contribution of methods to achieve interchangeability of assembled components, for which he was honored by being called the father of mass production, many milestones of improving manufacturing processing and techniques have been passed.

A study of the developments in manufacturing processes reveals a pattern by which large industries have made tremendous progress, particularly since the early 1900's. It is the purpose of this paper to show how manufacturing progress has been made through the process planning function of Process Engineering and, in so doing, present the steps in the *Thought Pattern* of the process planner.

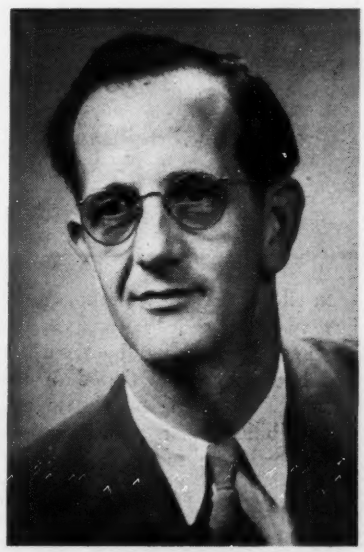
This pattern of progress apparently operates because of relationships which exist among its components: product design, materials, machines and methods. The words chosen to represent these components are obviously used in a rather broad sense. "Product design" may refer to either a complete automobile, refrigerator, or perhaps only a small working part. Likewise, "materials" is used to cover the field of both productive and nonproductive applications. In other words, it may denote the silicon steel suitable for motor lamination or the tungsten carbide for the die. Also, "machines" may include the massive presses for turret tops or the diamond boring machine for precision engine parts. And "methods," as used in this discussion, covers both the basic manufacturing processes and the related techniques.

Balanced Pattern

Industrial history shows how the relationships of the components of the pattern of progress continually change toward a balanced condition of these components as an instantaneous ideal. In other words, if progress is made in one of the components there must be a corresponding or even greater advance made in the others to bring the pattern into balance. The basic deign of the early steam engine was fundamentally possible, but the efficiency of the engine proved to be poor, probably because the specified fits could not be attained with the inadequate machines attempting to shape inferior materials. Even in those early days the product designer had offered a challenge to the makers of materials and the manufacturers of machines. Again, very shortly after the advent of the continuous rolling mill which produced a more uniform strip both metallurgically and dimensionally, the product designer was in a position from the material standpoint to offer the all steel body for automobiles. At the outbreak of World War II, when theretofore unheard of requirements were released for production of aircraft, a manufacturing methods problem became evident. Manufacturing techniques were brought into the aircraft industry from the related basic techniques of the automobile industries as the automobile industry had done in its pioneering days. Soon

THE AUTHOR

Edward Anson Reed attended Cornell University intermittently between 1927 and 1931. He graduated from General Motors Institute at Flint, Michigan in 1934. After gaining experience at the Chevrolet-Flint Manufacturing Division until 1937, Mr. Reed became an Instructor at the General Motors Institute and developed the Die Engineering Program. He has taught courses in Manufacturing Methods and Operations, Time and Motion Study, Process Planning, and Tool and Die Engineering and is at the present time a Senior Technical Instructor in charge of the Die Engineering Program. Mr. Reed is also a member of the American Society of Tool Engineers.



Edward Anson Reed

This 65,000 KW tandem unit, rated at 80% power facor, is among the largest 3600 rpm units now in operation. It is installed at the Springdale, Pennsylvania station of the West Penn Power Company.
—Courtesy of Westinghouse

it became necessary for the aluminum rolling mills to produce sheet and strip which would meet the physical and mechanical requirements of the designer's specifications as well as withstand the plastic working required in the manufacturing process.

In each of the illustrations, familiar to those of the field of engineering, one or more components have been developed as other components have demanded or permitted the development. This is the exer-existent Pattern of Progress.

An investigation of various types of industry to discover who in a typical organization is largely responsible for motivating such a formula for progress would undoubtedly lead to certain outstanding individuals in the upper management group. While this is generally true, the process planner, who commonly is a member of the tooling department, is also important.

The process planner is in a position to act as a coordinator of the four components of the Pattern of Progress.

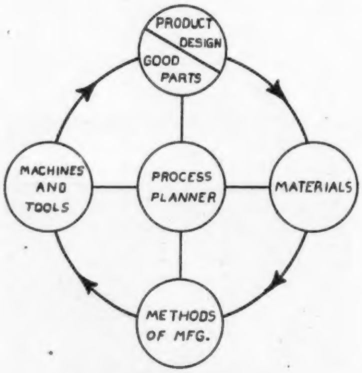


FIGURE 1

In effect, the process planner is a key man or coordinator, as diagrammatically shown in Figure 1, and becomes so positioned in the course of executing his duties and responsibilities. A typical definition of his duties is: to plan the operational sequence, to specify the necessary machines and auxiliary equipment, and to plan the necessary gaging required to economically produce good parts at a specified rate.

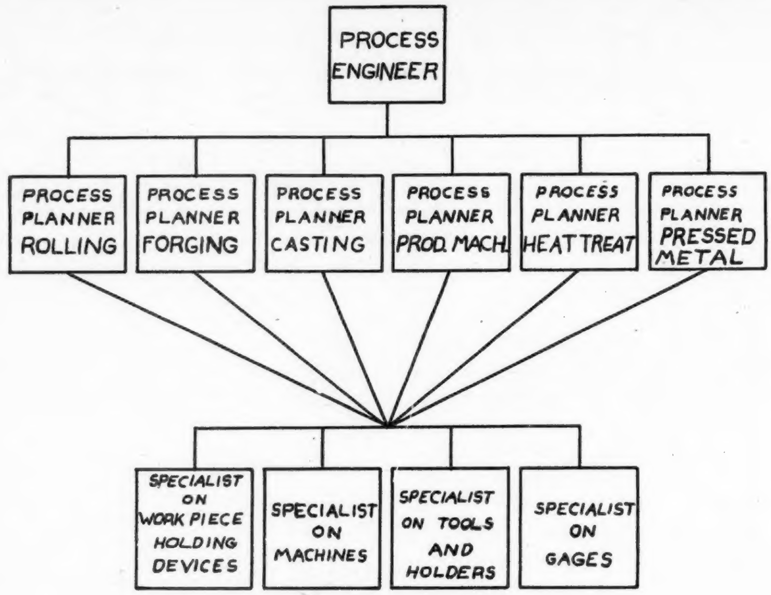


FIGURE 2

In the early days of industry there was no one individual in an organization who carried the title or had such broad duties to perform. Instead, the work of the process planner was more likely to be done by the tool designer or, perhaps, the machine shop foreman. As industries grew, those individuals who had the knowledge and experience of process planning eventually were set aside as process planners.

Training Suggested

At the beginning of World War II, when all types of metal working industries were rapidly expanding, it became apparent that there was an inadequate number of process planners who had become qualified by long years of varied experience and knowledge gained the "hard way." *Training* was immediately suggested, since it had been an aid in the solution to the problem of man-power scarcity in other specialized technical fields.

Training seemed the quickest and most practical solution, but when the time came for plant educational departments, in cooperation with General Motors Institute, to outline and develop an effective program of instruction for process planners it was discovered that no one could put into teachable form the *Thought Pattern* of the "old timer" who was doing the job of process planning.

Hence it was necessary to approach the problem by holding conferences with product designers, tool designers, machine designers, and production experts in attendance. A typical question by the conference leader* was: "How do you (tool designer) know that the flange of this forging should be machined first, using a chuck to hold the work piece?" In general it was found that the tool designer not only had no formulated thought pattern upon which he could base his decision, but also that no "language" existed by which he could explain his thinking even though the selection was sound tooling practice.

Obviously the example selected to emphasize the training problem which existed was from only a comparatively small division of the entire field of processing. The actual position of the process planner in

***Mr. Lawrence C. Lander, Chairman of the Industrial Engineering Department at General Motors Institute, contributed considerably to the field of Process Engineering since he was outstanding among those conference leaders who did the development work in Process Planning.**

the organizational mechanism is much broader.

In Figure 2 the process engineer coordinates the activities of the process planners in the various Basic Manufacturing and Founding Methods and depends upon them as a team to furnish the overall manufacturing process. This is necessary, for no one individual is sufficiently specialized in all basic manufacturing methods to plan the entire process. Furthermore, the process planner in a specific field such as productive machining must have the support of specialists on work piece holding devices, machines, tools and tool holders and gages, and must in some cases work with the process planners of other Basic Manufacturing Methods. Thus a complex gear may require forging, heat treatment, productive machining, selective hardening, and further productive machining to produce a part to the specifications on the part print or engineering drawing.

The steps in the *Thought Pattern* used by the process planner were originally developed by conference method for productive machining, but specialists in other manufacturing methods believe the steps of the thought pattern to be equally sound for process planning in their respective fields.

General Steps

The general steps of the thought pattern are listed in the sequence followed by the process planner.

1. Understand "What is specified".
2. Determine "What is required."
3. Determine the Founding Method.
4. Determine the Primary Manufacturing Method.
5. Determine the Secondary Manufacturing Method(s).
6. Determine the Primary Manufacturing Method Operation.
7. Determine the Secondary Manufacturing Method Operation.
8. Accomplish Primary Manufacturing Method Operation.
9. Accomplish Secondary Manufacturing Method Operation(s).
10. Implement Primary and Secondary Manufacturing Methods Operation(s).
11. Plan Methods of Gaging or Testing Part.

The following paragraphs will cover briefly the meaning of each step and the interrelationships which may occur in planning a sequence of operations.

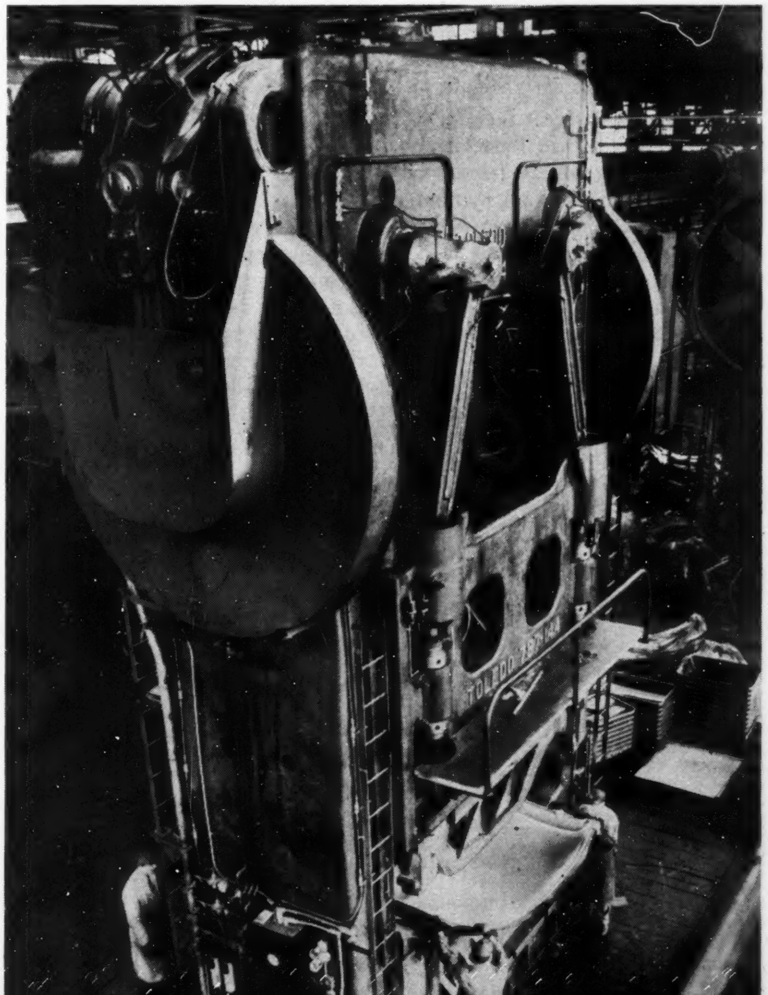
1. UNDERSTAND WHAT IS SPECIFIED—In this step the process planner must become thoroughly familiar with every type of specification on the part print. All dimensions with tolerances, notes such as for concentricity, squareness, parallelism, and surface finish, and notes on material and treatment must be very carefully studied. Frequently this study can be aided by the use of an experimental sample, models, or perhaps an enlarged layout of the part. Some process planners record all dimensions in tabular form to aid in placing the responsibility for each surface relationship.

2. DETERMINE WHAT IS REQUIRED—In performing step 1, the process planner will on most drawings find some inadequately defined specifications. Common among this type of specifications are smooth finish, break all edges, dimensions without tolerances and

(*Continued on page* 30)

Drawing a turret top in a double action toggle press ilustrates progress in product design and resulting improvement in material. Once the material, #1010 cold rolled steel, was available in suitable widths and physical and mechanical characteristics, the manufacture of such a part was possible.

—Courtesy E. W. Bliss Co.



The Creation of a Fabric

By BERNARD N. ROTH, ME '51

NOT yet an exact science, textile engineering of a new fabric combines the instinct and skill of a painter with constant applications of the ever growing science of textiles. To gain insight into the job now being done in this field, let us investigate this textile from its start as an idea in the designer's mind through its completion as material draped over a dress designer's form.

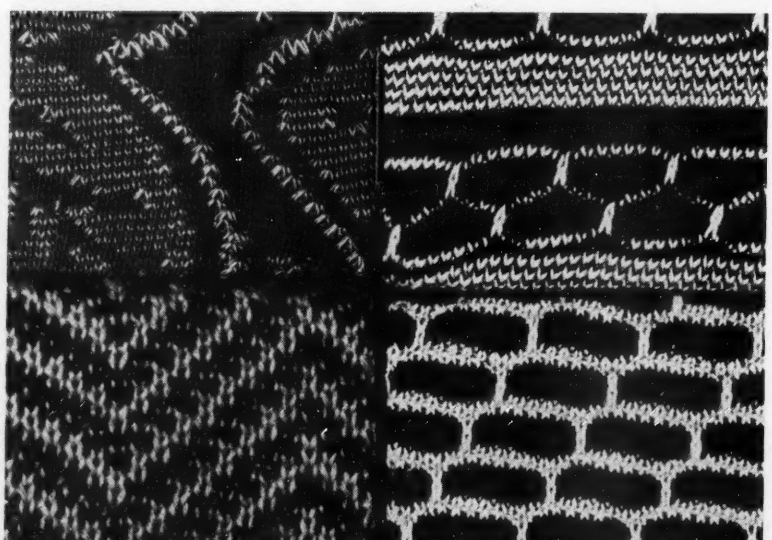
The designer's project is the creation of a new fabric for evening wear. He decides that his fabric will be white, of one of the silk synthetics as Nylon, Celanese, or one of the new fibers that are constantly being evolved by chemistry. It is distinctive because it is shot through with silver thread, not on the surface giving a garish effect, but interlocked in the heart of the fabric, providing a "hint of moonlight."

The model swirls down the ramp onto the main floor of the exclusive fashion salon. The long white gown is simple in design, but the fabric has enhanced the classic lines to a shimmering lunar loveliness. The dress is a "fashion first" because of the fabric, one of the newer products of textile technology.

The specifications of the prospective cloth are given to the textile engineer, who maps out the final technical specifications of the cloth. He determines the answers to many problems, and, on completion of his paper work, works with the plant's design mechanic bringing his cloth on paper into life, and then putting it into full production on the machines assigned to producing it.

Close teamwork and textile technology produce new cloth. Samples produced on Supreme circular knitting machines.

—Courtesy Supreme Knitting Machine Co.



The engineer's first problem is the type of machine to use in producing the cloth. Naturally he can go only as far as his facilities permit. But of the types of machinery he has, he must decide which machinery will give him the production qualities and details that his fabric requires. There are two classes of operation he could use, weaving and knitting. We will be chiefiy concerned with knitting. There are two types of knitting machines that may be used, producing two types of cloth differing in the finished properties. Warp knitting produces a cloth similar to woven cloth in line and structure. In this instance we may assume that circular knitting machines provide the required properties.

There are many types of circular knitting machines, which differ only in the nature of the operations to be performed in designs with complicated components. Some knitting machines are built for special purposes, as blanketing machines, hosiery machines, and sweater machines. All circular knitting machines are based on the principle of producing a circular tube of cloth, mechanically a linkage of fibers caused by an opposition of motion between a circular row of hooked or latched needls, and what may be called a knitting-cam ring, which causes strands of fibers to interlock in a chainlike manner. Knittink differs from weaving in that a knitted cloth will have fibers arranged as interlocking loops, while woven cloth is constructed of interlacing fibers at right angles to each other.

The engineer determines what

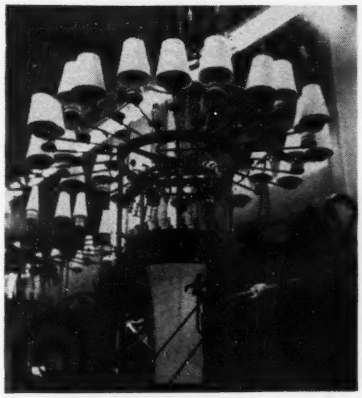
fibers are most preferable. In this case he uses two base fibers, acetate rayon and viscose rayon, knit together to form the body of the cloth, with silver thread running in a longitudinal pattern beneath the cloth surface. His final major problem is to lay out the designer's sketch on machine paper and convert this series of dots and crosses and red lines into mechanical data; the design mechanic translates these into little indentations on design wheels and special shapes on eccentric cams that provide the relative motion to knit the pattern into the cloth.

The planning specifications now are transmitted into actual cloth in the machine setup laboratory. There a pilot machine of the type which will finally be used on full scale production is set up to run cloth. Because of the lack of complete data on the physical properties of many fibers, this stage, that of putting mechanical data into actual gleaming cloth, is directed by experience and experiment. Many snags must be overcome before even the base rayons will knit on the machine into a satisfactory cloth. Much adjusting and many timing operations are necessary to achieve a good base for the silver that will give the fabric its unique appeal.

First Adjustments

Before the engineer and the design mechanic are ready to proceed to the problem of introducing the silver, they test the base for properties necessary in the finished fabric. They align the stitch to have a uniform stitch interval, a predetermined stitch number or count, and perpendicular stitch alignment. This cloth is the basic cloth, called plain-cloth. It has only the rudimentary "straight" knitting stitch of interlocking loops, in order to make the adjustments in its characteristics easily. The pattern wheels and cams are then adjusted one by one and the plain-cloth magically assumes the white design seen by the designer many weeks before. The engineer is now ready to introduce the silver thread into the white design to obtain the model for the cloth.

This silver thread is a product of the engineering skill of France. It is



Closeup view of circular jersey knitting machine in operation.

B. N. Roth

actually a silver coated yarn made by a secret process, which coats a thread fine as a human hair with a thin layer of refractory material and then covers the thread with an even coat of molten silver, all in one operation. The secret lies in having the coated metallic fiber retain the feel and workability of a fine yarn. The silver must be imported from France, and, as it costs almost $20 per pound, it must be used without waste or the final material will be prohibitive in price.

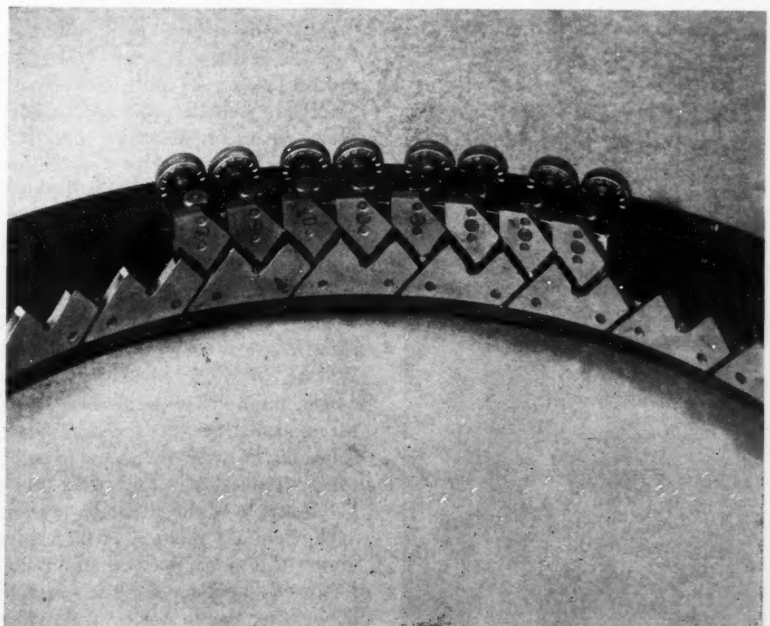
After perfecting the details of the new fabric, the engineer produces a test "run" on the cloth to determine the proper running conditions and to make an estimate of the production cost to be met in large scale production. All of the experience the engineer has gained while working on this new fabric is carefully recorded. These records are necessary if the findings warrant a patent on the fabric or on any procedures used and developed by its manufacture; they may prove helpful in working out similar problems. The engineer solves such problems as proper humidity for economical running and proper oiling or steam treatment of yarns before they enter the needle carriers and become cloth. By clocking time taken to knit a certain yardage, the engineer is able to determine labor cost and machine wear costs. These figures, added to the cost of special machine fixtures, finishing costs, and raw material cost per yard or per pound of cloth, determine the production budget, so that prospective buyers can be given an estimate of the price of the finished fabric.

A demand for the fabric causes it to be put into final full scale pro-

(*Continued on page* 30)

Partial view of cam raceway in which the knitting needle butt rides. The stitch and raising cams are shown mounted into position. Visible in rear are michormatic stitch control dials checking uniformity of stitch.

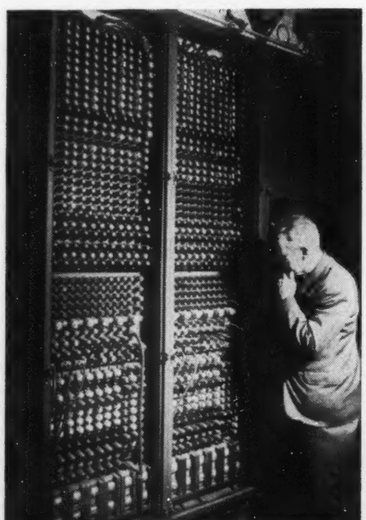
—Courtesy Supreme Knitting Machine Co.



ENIAC, The Electronic Computer

By JOHN H. GAY, EP '51

ONE of the latest contributions of modern science to an advancing world is that of electronic computers, of which the ENIAC (Electronic Numerical Integrator and Computer) is the prime example. Computing machines capable of performing the lengthy and laborious calculations integral to many phases of modern science and industry have long been needed by a fast-moving technological era. Research in the physical sciences is the key in this age but the problem of making practical applications of this knowledge gained in the laboratory is often greater than the original question. Major among these stumbling blocks attendant on making use of theoretical advances is the problem of performing the calculations needed in making up tables in a form usable to the engineer or technician.



Back view of two accumulators showing approximately 1100 vacuum tubes.

Laborious Work

The discoveries of J. Willard Gibbs, a well-known American physicist and mathematician, in the field of thermodynamics, serve to illustrate this point. Mr. Gibbs came upon certain general laws which, if applied practically, would have been of great benefit to the refrigeration, air-conditioning, heating, and other industries. Unfortunately, however, detailed calculations had to be made in the preparation of essential tables before this great theoretical work could be of any practical benefit to civilization. Many years of laborious computation were spent on this task before suitable tables could finally be prepared. Obviously some faster, more efficient computer than that which existed at the time needed to be designed.

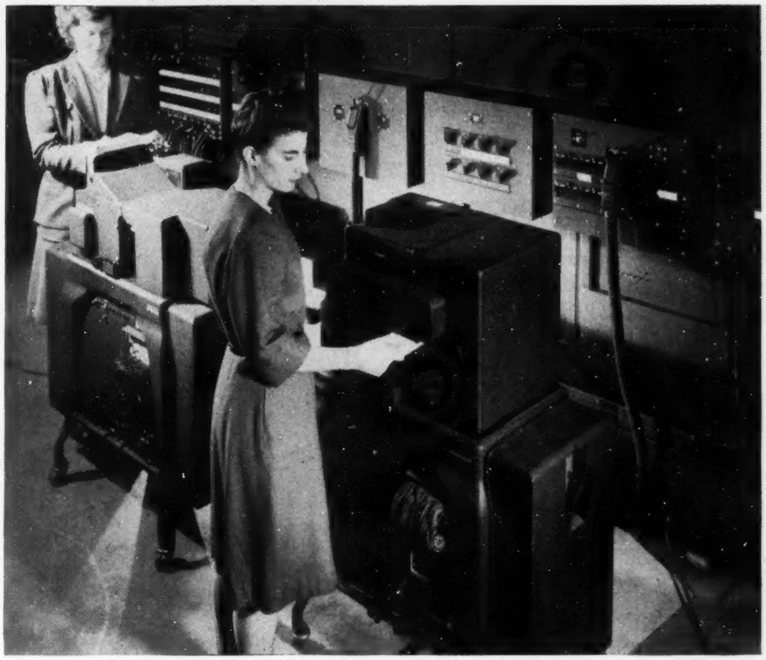
The need, however, remained just that until the advent of World War II. Many problems arose then which, unlike the one in the field of thermodynamics, needed immediate solutions in order for the war to be prosecuted successfully. One such bottleneck was the situation present in the field of ballistics. Firing tables giving the many corrections in trajectory of artillery for such factors as weather conditions, muzzle velocity, air density, type of ammunition, range, and so forth, were essential before larger guns of new design would be of much use in the field. The calculations, moreover, which would go into the preparation of such tables were of such magnitude as to make it almost unthinkable to attempt doing them with only the aid of the mechanical computing devices then in existence. It was estimated that, for example, using these machines, it would take a skilled computer three days of work to complete one such gun trajectory.

Again, routine tests on projectile shapes and sizes which were carried out in wind tunnels could have been, to a great extent, obviated by the existence of a high-speed computer capable of doing the work mathematically that the Ordnance Department was doing by analogy in these wind tunnels.

U. of P. Gets Project

Recognizing that this stumbling block existed, Captain Herman Goldstine and Colonel Paul N. Gillon, both of the Army Ordnance Ballistic Research Laboratory of Aberdeen, Maryland, urged the Ordnance Department to undertake the design and construction of the required computer. The project was turned over to the Moore School of Electrical Engineering at the University of Pennsylvania in the Spring of 1943 and, under the direction of Dr. J. W. Mauchly and Mr. J. Presper Eckert, of the staff of the Moore School, in collabora-

tion with Captain Goldstine and Colonel Gillon and the Moore School staff, the ENIAC (Electronic Numerical Integrator and Computer) was produced in the Fall of 1945 in answer to the pressing needs of war and, indirectly, the industrial problems of peacetime. At present the ENIAC is located at the Aberdeen Laboratory having been moved there during the summer by the Army in conjunction with the Moore School.



In the foreground is the output punch; the input card reader is seen in the background. Operators of the electronic computer need no special technical training.

Began With Abacus

Computing machines, of which the ENIAC is the latest refinement, date back to ancient times when man used certain crude devices to aid him with such arithmetical computations as he was required to make. These early devices spring from the "analogy" idea, in which the number or amount is represented by a certain number of objects or marks. The abacus, a product of the Orient which is still in use to a great extent today, represents well this method of computation, since with it calculations are made by moving counters strung on parallel wires.

The next great step forward came with the development of an adding machine by the great eighteenth-century French mathematician and philosopher, Blaise Pascal. His machine, albeit crude in comparison with later efforts, nevertheless stands as the first recorded effort in that field. Then, in the nineteenth century, Liebnitz produced a device which was capable of performing all four arithmetical operations. This contained all the essential principles in present-day mechanical computers.

With the advance of the physical sciences to include vastly more complex problems, devices were needed which could perform more specialized functions—computers, for instance, similar to the planimeter, which can be used to determine to a high degree of accuracy the area under a curve. The planimeter, then, marked another milestone since it represented the first mechanical integrator. Here computers left the field of pure arithmetic and entered the calculus. The next labor-saving device was the differential analyzer, first conceived by the great English physicist, Lord Kelvin, in 1876, and first successfully produced at M.I.T. in 1925 by Dr. Vannevar Bush. This machine was further developed and made more comprehensive during the years preceding World War II but it still left many questions unanswered. For instance, even though the differential analyzer was able to eliminate some work in the problems set forth by the research on ballistics, the major portion of it was still left to be done by individual computation. This was where the ENIAC entered the picture.

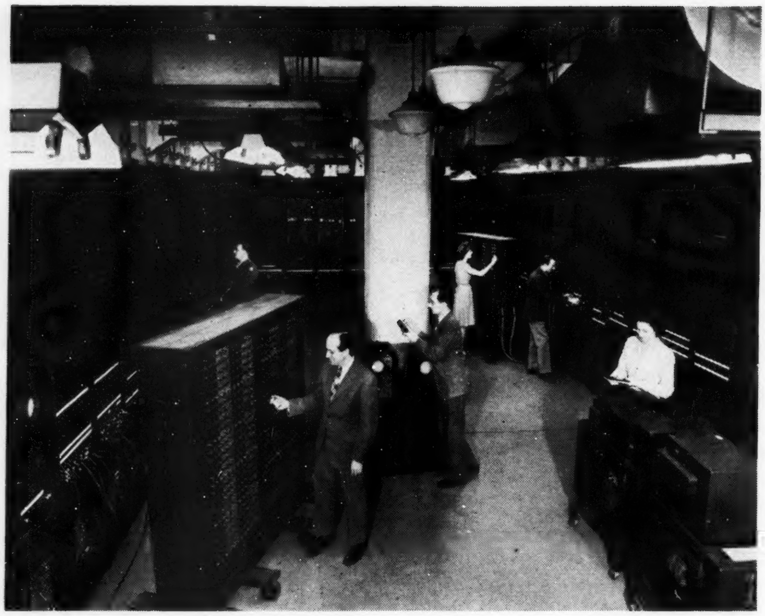
Visualize a room, 30 by 50 feet in size, with three walls lined by long rows of panels, and you have a good idea of the size and general appearance of the ENIAC. This computer, undoubtedly man's largest-scale venture in the field of electronics, reveals in its circuits 18,000 vacuum tubes, 500,000 soldered joints, 70,000 resistors, and 10,000 capacitors. These figures, vast as they appear, become even more staggering when comparative statistics are given for other well-known electronic devices. The most complicated radar set requires for its operation only 400 tubes; and even a B-29, the greatest and most complex flying unit in use during the last war, has less than 800 tubes in its entire structure. The framework housing such vast quantities of electronic equipment weighs 30 tons and has 100 linear feet of front panels.

Capabilities

Mammoth in size, the computer also has a wide range of applications. Ordinary arithmetical calculations can be made 1000 times as fast as was possible in the days of mechanical devices. In addition to this obviously valuable feature, problems of the calculus involving large numbers of variables may be solved through the use of the ENIAC where before only lengthy computations on the part of skilled mathematicians could produce any kind of satisfactory answer. Even so, in those pre-ENIAC days, to solve such equations in any practical length of time, certain approximations and assumptions had to be made which often ruined the value of the answer for precise work. Such failure of mechanical methods has been eliminated by this miracle of the electronic age.

Let us examine the structure and set-up of such a device. The units, of

which there are 40, may be divided into three main classes: arithmetic elements, memory elements, and control elements. The first of these, the arithmetic elements, include one multiplier, one combination divider and square rooter, and 20 accumulators. These latter units are used to store numbers arrived at in the course of a problem and also to provide the means for adding or subtracting numbers from these results. The operations may be carried out on numbers having as many as ten digits and will also indicate the sign associated with the answer. The multiplier and combined divider and square rooter perform such functions as their names indicate, the former being able to determine the product of two ten-digit numbers and the latter capable of working with numbers of as many as nine digits.



Over-all view of the ENIAC. Each vertical panel houses a different component of the electronic brain. After a problem has been broken into basic operations, the computer can solve it faster than any mechanical machine.

Memory Elements

The memory elements, both external and internal, provide the means whereby results, essential data, and instructions may be stored for later use in calculation or for future problems. The external memory is not a part of the ENIAC itself but is merely a mechanical system of punched cards on which computations may be filed permanently. The internal, however, is an integral part of the device and plays a major role in the solution of problems. This memory may be broken down into three groups according to the different sub-functions. First is the feature of retaining within the machine figures arrived at through earlier steps in a given problem. This is carried on within the accumulators. Then there is the memory for empirical data which must be supplied externally in order to set up the machine for computation. Such information may be set on one of the three function tables or on the constant transmitter and will be transferred when needed to the arithmetic units. A memory for instructions must also be included in order for successful operation. There is no specific unit for this function, however, because each section aids in it by following a routine established in advance.

The routine is set up by the controls which consist of the control and initiating unit, the cycling unit, and the master programmer. The initiating unit has as its main function starting and stopping the ENIAC while the cycling unit generates the impulses sent through the device. This section operates fundamentally with an oscillator sending forth impulses 100,000 times a second. Each individual impulse, having a duration of two millionths of a second, is fed into a 20-position electronic stepping switch, where the cycling unit puts out a special signal at every twentieth pulse of the oscillator in addition to the regular pulse every hundred-thousandth of a second. These special or "program" pulses mark the beginning and the end of each addition cycle—the basic arithmetic interval of the ENIAC. One addition may thus be completed in the time between two program pulses or in 20 micro-seconds. Other arithmetic operations, as set up and determined by the control units and coordinated by the master programmer, may be carried out in similarly short periods of time. It takes only 1/360 of a second to perform a single multiplication and only 1/38 of a second to obtain a result accurate to nine digits in either division or square rooting.

A problem to be solved by the ENIAC must first be set up in the form of usable equations by the investigator. These equations must then be broken down into the component operations such as addition, subtraction, etc., which can be set up on the ENIAC. The data necessary to the problem must be set up on the function tables and all instructions must be made on the control switches and the master programmer so that the proper sequence will be followed, and so that all impulse transfers from unit to unit may be coordinated in the proper manner. When all this has been done, the computer is set into action. As soon as an answer is ready, it is printed on punched cards by the printer. This is then interpreted by the operator and the problem is completed in a minute fraction of the time it would take skilled mathematicians working with the most advanced mechanical computers in existence.

Here then is a machine, amazing in its accomplishments and even more amazing in its promise for the future. Old and new questions will be answered through its use; and, with it, a scientific age can advance still more rapidly toward the attainment of a better world.

News of the College

Professor Ellenwood

Professor Frank O. Ellenwood, John Sweet Professor of Heat Power Engineering died in Rochester on September seventh after a short illness.

Professor Ellenwood was Head of the Heat Power Department at Cornell and senior professor in the Sibley School of Mechanical Engineering. Although he was not a graduate of Cornell, Professor Ellenwood had been on the faculty since 1911 when he came to Cornell as an assistant professor from Stanford, where he graduated in 1908.

Professor Ellenwood was a member of ASME and SPEE, ASPE, Sigma Xi, and Tau Beta Pi, and was co-author of "Heat Power Engineering" and "Vapor Charts" and author of "Steam Charts."

In 1915 he was advanced to the rank of professor and in 1940 was made head of the Department of Heat Power. From 1917 to 1919 he served as head of the engine department of the U.S. School of Military Aeronautics.

Professor Ellenwood was active in many organizations and a nationally known authority on thermodynamics, refrigeration, air conditioning, and engines.

Professor Ogden

Professor Henry Neely Ogden, a member of the Cornell School of Civil Engineering faculty for forty-seven years died on September 29. Professor Ogden received his early education in Philadelphia and obtained his Civil Engineering degree from Cornell in 1889. He was appointed an assistant professor in 1889 and later advanced to the rank of professor. He retired in 1938 as Professor Emeritus of Sanitary Engineering. Professor Ogden was a member of Pyramid and various engineering and public health societies and supervised construction of the Nurses Home and power plant at the Tompkins County Memorial Hospital. At the time of his death Professor Ogden was 79.

Awards Offered

Resumption of an award and scholarship program has been announced by the James F. Lincoln Arc Welding Foundation. The program began in 1942 but was interrupted by the war, and has now been reinstituted. To stimulate interest and research in the field of arc welding, the Foundation will award cash prizes for the best undergraduate student papers relating to the design for arc welding of parts of machines or of engineering structures. First, second, and third prizes will be 1000 dollars, 500 dollars, and 250 dollars respectively; and many smaller prizes will also be awarded. In addition, the institutions whose students win the first three prizes will receive amounts of money equal to those prizes, to be used for scholarships. The papers are to be submitted by May 15, 1948.

Dean's Activities

S. C. Hollister, Dean of the College of Engineering, has been invited by General Courtney H. Hodges, U. S. Army, to serve on a local advisory committee being set up in Ithaca. General Hodges is setting up an "Army Advisory Committee" in each community in the First Army Area to establish closer contact between the Army and the civilians it serves.

Dean Hollister will travel to Washington on November 11 where he will attend a meeting of the Engineering Division of the Association of Land-Grant Colleges and Universities. In addition, the Division will hold a joint meeting with the American Society for Engineering Education, the Engineering College Administrative Council. Dean Hollister is attending both of these meetings as the representative from Cornell.

Appointments

Two new assistant professors have joined the faculty of the School of Civil Engineering. Charles D. Gates received his B.S. from Williams College in 1937, and an M.S. in Sanitary Engineering from Harvard in 1938. He has held several positions in the field of sanitary engineering and water purification. George B. Lyon was granted a B.S. by the University of Illinois in 1940 and an M.S. by the University of Iowa in 1942. Later he was a junior engineer with the U. S. Engineering Department Hydraulics Laboratory at Iowa City, and assistant engineer in the Illinois State Water Survey. Before coming to Cornell he was an instructor in civil engineering at the University of Minnesota.

Joining the Laboratory of Nuclear Studies is William M. Woodward, recently appointed assistant professor of physics. He received an A.B. from Columbia in 1938 and a Ph.D. at Princeton in 1941. After a year of research for the Army at Princeton, he joined the Manhattan Project at Los Alamos in 1942, and has recently been engaged in teaching and research at M.I.T.

Dixon Wins Prize

An award of $800 from the Freeman Fund of A.S.C.E. has been made to Lt. Col. George F. Dixon, Corps of Engineers, now taking post-graduate work here, for a study of European installations to maintain harbor channel depths by induced scouring. Originating from the $25,000 fund established by the late John Freeman, past-president and honorary member of the Society, the award will aid Col. Dixon's research. Titled, "Investigation of European Method of Harbor Channel Control by the Use of Regulatory Works," Col. Dixon's

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The Editor's COLUMN

Rounding An Education

The goal of the collegian is a fine education compounded of hard and serious work (so they tell me). But there are more modern factions who insist that it is not the formal education alone that counts, but the *well-rounded* education. The five-year program is purposely attempting to help this idea along by making available more hours for supposedly cultural subjects. However, many schedules show that all elective hours are needed for further specialization in engineering. It seems that even five years are not enough to cultivate diverse talents and interests for that well-rounded education.

If the student wants to keep his non-technical interests active, classes cannot do half as much for him as participation in outside activities. Extracurriculars have helped decide vocations. What more useful and convenient "minor" could one undertake than music, journalism, art, or administration through such outside work? Another point is that an employer is more inclined to favor someone who has proven himself able to work with others. Not to be forgotten is the personal satisfaction derived from the extra activity.

Then comes the big question. How much time can I allow for outside activities? If you're looking for the time, *it's right there,* waiting for you to sit down with paper and pencil and find it by some careful budgeting. A schedule and enough perseverance to stick with it mean everything.

The freshman is inclined to say "no" at first to competitions because of visions of all-night study routines. Perhaps the best method for the first year engineer is to wait a couple of terms in order to find just how much time is ordinarily needed for studies. However there is the danger that the end of this period of waiting will find sloppy habits formed, breakable only by great effort.

PROMINENT

Punky

Robert W. Persons, EE

Robert W. Persons, electrical engineer, mechanic, artist, party-boy, and all around doodler, claims Bayside as his home town and Phi Kappa Psi as his local residence.

At the tender age of three Bob was blessed with the nickname "Punky." He wore others of a less permanent nature as he grew up. Reaching the draftable age of eighteen, he was screened into the Navy V-12 program. Informed that he had an aptitude for electrical engineering, he was hustled off to Cornell so that his potentialities might be recognized. Having spent a portion of his naval career at Cornell and elswhere—"in Navy mess halls on work details" according to Punky—he was eventually discharged and returned to Cornell last fall.

Back into the rigors of following "stray fields," he was elected to Tau Beta Pi, honorary engineering society, verifying his reported aptitude for electrical engineering. Although he admits he enjoys the "stuff," for him it is primarily only a means to an end. Actually, he has a preference for painting and drawing—"art in any form." His latest endeavors are hand-painted ties and a paint job, maroon and pale ivory, on a contraption referred to as an automobile, vintage '32. Strictly modern in appearance as far as paint jobs go, the car's ability to cope with the icy hills of an Ithaca winter remains to be seen.

Punky is adept at things both large and small. He likes to work with miniature model trains. As social chairman of his house, he was responsible for organizing the Phi Psi lawn party of last spring. He logically concludes that this was experience in the "art of planning."

Punky will graduate in February. Until then, his plans call for nothing except the enjoyment of Cornell and its social program, a better car, and enough studying to remain in good standing with Eta Kappa Nu, the honorary scholastic society of the electrical engineering school to which he belongs. Following graduation, with nothing very definite in mind at this time, he thinks that he "will go to work." But for now, the sight of maroon and ivory will assure you that Punky is still riding high at Cornell.

Raymond Schumacher, ChE

One day when Ray was a small child back in Brooklyn he came across a copy of the *Widow* and he relates. "From that day onward I had an unconquerable desire to go

Ray

to Cornell."

The family moved to Garden City, Long Island, after Ray had completed one year at Brooklyn Technical High School. He finished secondary school at Garden City High where he ran track and cross country and was on the rifle team.

Upon graduation Ray packed off for V.P.I. and his unconquerable desire seemed fairly well conquered. However, fate stepped in as it often does in these sketches. In November of 1943 Ray took the now famous V-12 test and, wrote as his preferred school, Cornell University. He passed and oddly enough was sent to Ithaca. He was allowed to continue in Chemical Engineering and did so without mishap.

Completing six semesters he was commissioned an ensign in the Navy and served aboard a light cruiser in the Atlantic. He was discharged in July 1946 and returned to the hallowed halls of Olin last fall.

Ray has served as president of Lambda Chi Alpha and as a members of The Faculty Committee on Student Activities. He is now treasurer of Tau Beta Pi, secretary-treasurer of Al Djebar, and a member of A. I. Chem. E.

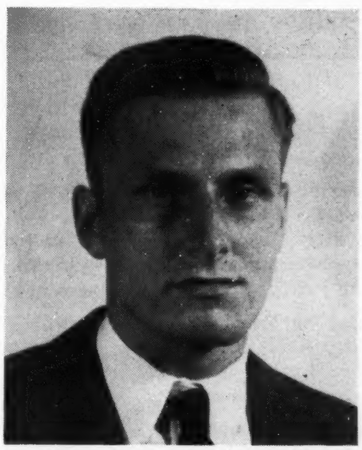
If all goes well he will graduate this February. When asked to comment on his career, Ray grinned, "That - - - *Widow.*"

Jack Davidson, ChE

Jack Davidson is a staunch believer in the theory that we should "See America First." His early years were spent attending grammar schools in nearly every state east of the Mississippi. Finally he alighted in Kenmore, New York and graduated from Kenmore High School, having played on the varsity football, and intramural basketball and baseball teams.

After a semester as a civilian at Cornell, Jack became one of the first members of the Navy V-12 Unit here, deciding on Chemical Engineering as a likely profession. Evidently it was a wise choice, as his excellent record shows. During the few hours he managed to sneak away from his cell in Olin Hall he played on the '43 and '44 football teams, became a member of Tau Beta Pi and the Al Dejbar Society, as well as the A.I.ChemE.

A brief interlude in Jack's career was spent in the Pacific aboard a Navy transport where he advanced rapidly to the rate of Fireman 2/c —probably a result of his engineering training. The honorable discharge arrived in April, 1946, and



Jack

with it a return trip to Cornell in the fall of 1946.

Since his return Jack has maintained his scholastic average and has become a member of Lambda Chi Alpha. During this past summer he did pilot plant work for the National Aniline Company in Buffalo. The afternoons find him working out with the football team and during odd moments you are likely to find him absorbed in a book on nuclear physics. To most of us this would be rough going, but for a fifth year student in Chemical Engineering it is relaxation.

Jim

James W. Macdonald, CE

Jim Macdonald entered Cornell with the Class of '46 way back in October of 1942, and like a good number of his Civil Engineering class-mates, finds himself still an undergraduate when under ordinary circumstances he would have been out earning a living.

Jim was born in Winnetka, Illinois and attended Trier High School there, but now lives at Glencoe on Chicago's North Side. His father is a designer and builder of industrial plants and Jim plans to go to work for him when he graduates. At Cornell Jim has made a fine record both in and out of his classes. He managed to complete five semesters before the Navy called him, and in that time proved again that it is possible to combine extra-curricular activities with class work and emerge on top in both. In his abbreviated stay at Cornell, before leaving for the Navy, Jim was coxwain for the Frosh Crew and later served in the same position on the J.V. Crew. In the meantime he had gone out for and won the Basketball Managerial Competition, and just before departing for the wars was elected to Tau Beta Pi.

Jim spent two years in the Navy as a Radio Technician, repairing and maintaining radio and radar equipment. This was interesting work, Jim admits, but before he had completed the course the war was over. He did not see combat, but

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Cornell Society of Engineers

107 EAST 48TH STREET 1947-1948 NEW YORK 17, N. Y.

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Message

IN the last issue of the Cornell Engineer I told about the officers and committee chairmen of the Society's organization, and said another time I would mention the other members of the executive committee, whose function it is to represent the respective engineering colleges.

Mechanical Engineering is represented by Rudolph M. Triest, '12, Vice President of John Wiley & Sons, the book publishers, and by William Littlewood, '20, Vice President in charge of engineering of American Air Lines.

Civil Engineering's representatives are Carlton Reynell, '06, official of Worthington Pump, and John P. Riley, '21, director of research and development of the New York City Housing Authority.

Members for Electrical Engineering are George T. Minasian, '18, of the Consolidated Edison Company of New York and Walter M. Bacon '30, research engineer of the Bell Telephone Laboratories.

For Chemical Engineering the representatives are Henry A. Gundlach, '11, consulting chemical engineer in Baltimore, and L. Van Lee, '42, of DuPont Pigments in Newark.

All of these men are active in Cornell affairs generally as well as in the Society. I believe the other members of the Society will be interested to know who they are. They contribute freely of their time to attend all executive committee meetings, and take full part in the consideration of all questions.

* * * * *

Your attention is called to two new names in the masthead. Ira L. Craig, '08, of the Philadelphia Electric Co. has succeeded Creed Fulton as vice president for the Philadelphia region, and William F. Zimmerman, '34, of the Pass & Seymour Company has accepted the leadership in the Syracuse branch, which has been inactive for some time. The support of Cornell engineers in those areas for these new officers is earnestly requested.

* * * * *

A recent survey and report by the *New York Times* on college enrollments and costs throughout the country has, I trust, brought to a larger audience the central problems with which college administrations are faced and with which interested alumni are familiar at least in general terms. The problem of increasing faculty salaries and meeting other higher costs is accentuated by the record high enrollments. College education is one field in which increased volume does not result in lower costs, since an additional student's tuition and fees do not cover the added expenses.

This is a point which we as alumni should keep in mind, particularly as many persons appear to believe that the large Government expenditures for veterans' education should ease the problems of the colleges. Certainly the need for financial support by the alumni has increased rather than diminished.

The figures on enrollment in many of the colleges raise some interesting questions as to what we as alumni of the Cornell Engineering Schools think would be the right size for our own colleges to aim toward. Any of you who have definite opinions on this question are invited to write and advise us so we may better represent the alumni viewpoint.

CARL F. OSTERGREN

Alumni News

Emmet F. Hitch, Ph.D. '12, special assistant to the management of the Du Pont Company's Chambers Works, Deepwater Point, N.J., retired on September 30 after 29 years with the company. He is joining the faculty at Purdue University as a professor in the department of chemistry. His wide teaching experience included four years at Cornell from 1909 to 1913, where he received his doctorate in 1912.

Norman J. Gould, M.E. '99, president of Gould Pumps, Inc., of Seneca Falls, has been named a director of the National Association of Manufacturers.

John D. Bailey, C.E. '00, completed forty-one years as engineer for the Buckeye Pipe Line Co. before serving as chairman of the wartime OPA in his district. He now lives in retirement at his home in Lima, Ohio.

Herbert F. Bellis, M.E. '11, of Forest Hills, is an engineer with the Long Island Lighting Co. of Mineola.

Louis R. Gons, C.E. '13, was elected president of the Rotary Club of New Brunswick, N. J. He is a general contractor in the firm of Rogers and Gons Construction Co. in New Brunswick.

James C. Travilla, M.E. '22, has been named vice-president in charge of engineering for Commonwealth Steel Co., which was the predecessor to General Steel Castings. Since then he has served in several capacities for the organization, including that of chief engineer from 1940 to date.

Henry M. Beatty, E.E. '22, is vice-president in charge of operations for the Cleveland firm, Kelley Island Lime and Transport Co.

George I. Brayman, C.E. '22, has returned to the contracting business and is presently engaged in the construction of several bridges in the Kittanning, Pa., area. He recently spent two years as plant engineer with the Pittsburgh Forgings Co.

George A. Hess, C.E. '26, is chief structural engineer in the San Francisco consulting engineering office of Leland S. Rosener. His home has been in California for the past six years, after his work in the Canal Zone.

John W. Ackerman, B.Chem. '28, M.Chem. '29, Ph.D. '31, has resumed his former capacity as president of the Fine Colors Co. of Paterson, N. J.

Herbert F. Cox, Jr., M.E. '33, is now manager of the square container division of the Sealright Co. at Fulton, N.Y. His previous work since graduation has been with the American Can Co. in New York City.

Stephen M. Lounsberry, Jr., M.E. '36, is a partner in the Owego firm of Steele and Lounsberry, which he helped form from the business of his former employers, the Moore and Steele Co.

Alan B. Mills, Jr., C.E. '36, is now serving as superintendent of construction at the new lime plant being built at Kimballton, Va., by the National Gypsum Co. He is associated with the George A. Fuller Co., Washington, D. C.

Edward A. Miller, C.E. '37 and M.S.E. '43, is chief engineer of the building panel division of the Detroit Steel Products Co. of Buffalo. With him are three recent graduates, Robert C. Findlay, '43, Robert M. Brown '45, and William Zuk, '45.

G. Page West, Jr., M.E. '38, is a sales engineer with the Davison Chemical Corp. in Maryland.

William E. Fisher, C.E. '40, has turned to law, and after graduating from Harvard Law School recently joined the office of Schultheis and Laybourne in Los Angeles.

Roy A. Pettersen, E.E. '40, holds the position of engineer with the transportation division of the General Electric Co.

Edward J. Kendrick, B.C.E. '43, is a member of the Albany firm of Barker and Wheeler, consulting engineers.

Alfred D. Sullivan, B.M.E. '43, was appointed chief engineer of the Brunner Manufacturing Co., a Utica concern engaged in the manufacture of air compressors and refrigeration units.

Robert H. Garmezy, B.E.E. '43, B.M.E. '45, has continued his education with his employers, the Chrysler Corp., and recently received the degree of Master of Automotive Engineering with highest honors at the Chrysler Institute of Engineering. His Cornell degree in electrical engineering was also given with distinction. His present position is as a junior engineer in the Chrysler electrical department.

Joseph S. Hollyday, B.S. in E.E. '44, is a transmission engineer with the Central Hudson Gas and Electric Corp. at Poughkeepsie, N. Y.

Died

Theodore Finch Lawrence, C.E. '88, president of the Chester National Bank.

Christopher H. Bierbaum, M.E. '91, founder of the Lumen Bearing Co. After his graduation he spent four years as an instructor in Experimental Engineering, invented the microcharacter for studying metals, made the first phosphor-nickel bearing alloys, and did original research in the field of bearing corrosion by oxidized lubricants. He was a practicing consulting engineer, author of **Handbook for Engineers and Machine Designers,** and the ASME member of the U.S. Bureau of Standards Committee for Metallurgical Research.

Heatley Green, M.E. '01, founder and president of the Automotive Products Co. of Detroit, Michigan.

John A. Skinner, C.E. '01, civil engineer serving several railroads.

Edward A. Fisher, C.E. '05, city engineer of Lakewood, Ohio, from 1914 to 1947.

Roy H. Cunningham, M.E. '11, mining engineer, associated at dif-

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Recent Developments In Engineering

Techni-Briefs

Radiant Heat Test

An eight-story apartment building now under construction on the campus of the Georgia School of Technology will provide architects and engineers their first opportunity to study the differences between radiant and convector heating systems in a multi-story building. The structure, a part of a student housing project, is being built in the form of the letter "H." One wing will be heated by means of wrought iron pipe coils concealed in the concrete floor slabs and the other wing of conventional type convectors.

While there are some multi-story buildings now using radiant heating systems in this country, this is the first ever to incorporate both radiant and convector types. Both the architectural and engineering departments at Georgia Tech plan to study the systems when they are functioning. Operation costs, as well as performance data, will be recorded. The Georgia Tech apartment is expected to reveal accurate data on differences between radiant and convector type heating because construction is identical for the areas in which the two types of systems will be used.

Artificial Precipitation

Artificial production of snow or rain constitutes something more than merely dropping dry-ice out of an airplane says G. E.'s Vincent J. Schaefer. Assuming the proper natural weather conditions, Schaefer pointed out that his techniques produce snow first. Then, depending upon temperature and humidity of air beneath a cloud that has been turned to snow, the snow produced can fall to the ground as snow, or as rain, or it may evaporate during its fall so that no effect is observed on the ground.

The primary weather condition necessary is that the clouds to be changed to snow or rain be "supercooled." This is a condition in which the moisture of a cloud is below freezing but is still liquid. Schaefer listed four other requirements for producing snow or rain:

(1) The supercooled portion of a cloud should be at least 500 feet thick to initiate any appreciable change in the cloud.

(2) Dry-ice pellets used for seeding a supercooled cloud should be no larger than necessary to drop through the supercooled region. Pellets the size of a pea will fall several thousand feet before evaporating.

(3) Seeding of a supercooled cloud is most effective when dry-ice is dispensed meagerly. A gradual distribution of 1½ pounds per mile has proved most effective.

(4) Amount of humidity or moisture in the atmosphere beneath the cloud should be determined. If this atmosphere is too dry, any precipitation caused may evaporate before it reaches the ground.

Jet Ice Boat

A 1600-pound jet-propelled ice boat was recently tested in New Jersey. According to its sponsors it will attain a speed of 200 miles per hour. Similar in appearance to an airplane fuselage, this stainless steel craft is mounted on three runners and carries two tanks containing liquid oxygen and alcohol which are combined to provide the propulsive power.

Special Camera

A new camera with a speed of one-millionth of a second which produces a finished photographic projection within thirty seconds after the picture is taken has recently been developed. The camera, two feet long and one foot high is not portable, and is not intended for use by the camera-fan. Fully automatic with the press of a button, it is part of equipment developed for the rapid testing, by means of electrical power surges, of apparatus used in the generation and transmission of electric power.

High Voltage Tubes

A new vacuum tube design for use in high voltages at altitudes up to 60,000 feet has recently been developed. The development work was sponsored by the U.S.A.A.F. and the tube is especially important in control circuits of guided missiles.

The base of the tube is glass and is tapered and ground to fit the socket like a glass bottle stopper. This construction excludes all air which, at high altitudes, causes flash-over between terminals. The tube socket is the exact counterpart of the tube, insofar as the taper is concerned.

The socket is made of Mycalex because it is a bonded glass mica composition which will not carbonize in the event of an electrical breakdown. The new design is applicable to all types of high voltage vacuum tubes which may be subjected to similar high-altitude conditions. When used in areas which are strongly radioactive, tubes of this type will not break down externally due to ionizing action.

Locating Minerals

Geiger counters are now being used in mining work to discover numerous minerals. This new divining rod, recently publicized, will locate radioactive veins by indicating the presence of radioactivity. The presence of radioactivity is also used to locate heavy minerals other than the radioactive minerals since there is a tendency for radioactive minerals to associate with certain of the other heavy minerals.

Out of Phase

By HERBERT F. SPIRER, E P'51

Session With Sitzy

Vladmir Sitzfleisch, valedictorian of Sibley, looked up at me with soulful eyes that were limpid pools of blood. I offered him a wad of my Olin Chaw (a delightful, scintillating mixture of equal parts of used chewing gum, desiccated antimony, artificial hydrogen, and selected Turkish prelim books). Vladmir leaned forward and cut off a hunk with the tin snips he wore on the third finger of his left hand. Here, I thought to myself, is an engineer proud to be married to his profession, proud to have no other love than Dean Hollister, no other creed than F=Ma.

"Why the bloody gaze, tovarich?" I asked.

"Austin," he replied cracking his knuckles.

"Automobile?" I queried, brushing the c r a c k e d fragments of knuckles to one side.

"No, Austin Dulin of the Underwood School of Bridge Experts. He and his mother were standing on a sidewalk looking at a dentist's showcase. 'If I had to have false teeth, mother, I'd like to have that pair,' said Austin, pointing. 'Hush, Austin; interposed his mother. 'Haven't I told you not to pick your teeth in public?' How's that Rodney?"

"Not bad at all," I countered, poking him between the ribs with an I-beam. "But here's a true story for your notebook. It happened during the Summer Session.

"One afternoon Miss Leo Altman, prettiest co-ed in the Timoshenko School of Engineering Physics, was sloshing about merrily in the brackish waters below the Suspension Bridge. Suddenly she slipped on a mossy rock, and fell rapidly into the dangerous roaring falls. Her screams for help were drowned out by the roaring of those dangerous roaring falls.

"And then to the rescue sprang a knight in shining armor. His strong arms reached out and pluck, ed, by the back of the neck, our heroine from the briny deep. After saving her life, the unknown rescuer and Miss A. chatted of thisa and thata. She told him she was an EP.

"Well, wasn't that just dandy? He too was connected with the Physics Department, but he only had a job there. His name? Well, she could just call him Dick.

"And so, Sitzy, when I arrived for my afternoon immersion, Miss A. casually asked if there was anybody working in the Physics Dept. named Dickie Feynman. Yes, I had to admit there was such a person in the Physics Dept. He didn't have much of a job. Oh, No! Just a measly little old associate professorship."

Vlad Saves Face

Vladmir yawned loudly, boredom written all over his face. He took out an eraser and erased the writing.

"Veddy interesting, Rodney . . . but have you heard about Brate Bryant, EE '50, who was searching all over Rockefeller for a Professor Thomas Boulian?"

"Heh, heh, Vladmir, you should go back to the tar pits. After all, remember when I found Milton Collins hunting in the trig tables for the value of the sine of the flying red horse?"

Sitzfleisch tucked his drawing board into his watch p o c k e t, laughed eerily and threw himself in front of the Stewart Ave. bus. Quiet reigned on the campus.

Alumni News

For some reason it has been the pleasure of the ENGINEER to be the recipient of a little newspaper called the Clipsheet of the Board of Temperance. One little item in a recent issue attracted our attention. Here it is:

Recently, a man suffering from acute alcoholism, was picked up on the streets in Washington. The news report says that his identity was unknown but that he was about fifty years of age, without teeth, with a five-inch scar on the right side of his forehead, and grey-streaked, brown hair.

It is a report which tells a lot. He had no teeth because there was no money for dental service; he had a five-inch scar because drunkenness leads to brawling; he had grey in his hair, which means he was approaching the years of dependency, the twilight of his life. No friends, no health, no money, old age knocking at the door, and nothing but drink addiction to "comfort" the last years of his life.

In an effort to track down this story to the limit, since the man described bore a resemblance to one George Barbleman Splotzkipedus, Architecture '09, who was famous for handing the president of the University a pint of Three Rivers Blended in return for his sheepskin, we sent a man to Washington, D. C. The report of ENGINEER special agent-9 is reproduced . . .

"Contacted unknown alcoholic as requested. Details of method of contact will appear on expense account. Victim answers to name of Oscar, George, Stupe, and Hey You. Likes to hum "Far Above Cayuga's Waters" when he has a crying jag on. Found Yale-Cornell ticket for '08 on chain around his neck. Barks furiously at all women from ages 3 to 103. Since he is unable to perform simplest arithmetic operation with his shoes on I conclude that he is our missing architect. Yours, Fosdick."

College News

(Continued from page 15)

project is aimed at study of methods employed at Bremerhaven, Bremen, Rouen, Havre, and Ostend. In his European work, he will make a study of possible savings in the cost of dredging in the United States.

A.S.M.E.

At least one meeting every two weeks is the goal of the Cornell Student Section of A.S.M.E., which is headed this term by Robert Heath, president; Joseph Danko, vice-president; and John Friedrich, secretary. Three meetings have already been called. On September 30, University Provost, Dr. Arthur S. Adams, who was at one time Acting Dean of the College of Engineering, spoke on "The Engineer as a Citizen." Dr. Adams described the field of political thought as the one area in which engineers do not fulfill or even realize their responsibilities. He implored the young engineers in the audience to become interested in politics, to think political problems through for themselves without repeating hearsay or propaganda, and to speak out their own opinions without shame or fear.

Mr. G. F. Akins spoke October 23 on the topic, "Automatic Controls." Mr. Akins, an instrumentation engineer for Eastman-Kodak, brought with him demonstration equipment to illustrate basic modes of control. Dr. R. O. Fehr of the General Electric Company addressed the group on October 8 on "The Fight Against Vibration and Noise."

The ASME has occupied a new headquarters in Room G in the basement of West Sibley.

Tau Beta Pi

Tau Beta Pi, national honorary engineering society, launched its activities for the new academic year at Cornell with the sponsoring of a class on the use of the slide rule. The class, intended primarily for freshmen, but open to all students, was held first on October 6, and again on the three following Mondays, in the Main Lecture Room of Baker Laboratory. A 45 minute lecture and demonstration was followed by a question period and group practice.

A.I.E.E.

The Ithaca Section of the A.I.E.E. held its first 1947-1948 season meeting on Oct. 3. A dinner at Willard Straight was followed by a technical program and laboratory demonstration by Prof. Stanley W. Zimmerman, assisted by Prof. Mason W. Peterson, of the University High Voltage Research Laboratory. "High Voltage Phenomena" was the topic of the program held at the Laboratory. Refreshments and a social get-together followed the demonstration.

New Facilities

A new building with much new equipment has been completed and will be used for instruction in machine tools. The cost of construc-

(More news on page 26)

College News

(*Continued from page* 24)

tion was supplied by Federal funds. The new building is located adjacent to Beebe Lake and will be known as Building No. 3.

There has been a continuing development of the new airport buildings at the East Hill Airport. These facilities are intended to be used in connection with instruction, research and development in aircraft engine combustion and jet propulsion.

Book of Rules

The College of Engineering has revised its rules and published them in a new *Book of Rules* for the guidance of undergraduate students. This brochure is being made available to all students in the College. The most noteworthy revision is the new requirement that students in the School of Civil, Mechanical, and Electrical Engineer ing must maintain an average grade of 70 per cent. The School of Chemical and Metallurgical Engineering and the Department of Engineering Physics have continued their requirement of 75.

King, Geer Travel

Professor W. Julian King, director of the School of Mechanical Engineering, and Professor R. L. Geer, traveled to Chicago Sept. 16 to visit the National Machine Tool Show held in the Dodge Chicago plant. The show featured many exhibits of the latest machine tools and was attended by 100,000 employees and officials of the machine tool industry.

Turbine Purchased

A new Westinghouse steam turbine has been purchased and installed in the Mechanical Laboratory. This highly regarded piece of equipment was built especially for use in educational institutions and is the latest word in special educational laboratory equipment.

Heat Pump Trial

In the July issue of *Heating and Ventilating* is an article describing an experiment in home heating carried out by William F. King and Michael S. Martus, both MS in Engineering '47. The purpose of the experiment was to determine

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College News

(*Concluded from page 26*)

whether or not the ground is a satisfactorily steady source of heat for the use of a heat pump. A fifty-foot length of coiled copper tubing was buried under the floor of the West Mechanical Laboratory, and connected to a source of chilled water. Measurements of rate of flow, and of the water temperature at the beginning and end of the tube indicated that the ground does supply heat steadily and in sufficient quantity. The experiment was carried out under the supervision of Prof. C. O. Mackey.

Alumni News

(*Continued from page 19*)

ferent times with mining firms in the West Indies, Arizona, and West Virginia.

James Monroe, M.E. '09, official of engineering and air-conditioning companies in Cleveland and Cincinnati.

Henry S. Holmes, M.E. '12, electrical engineer with the Metropolitan Engineering Co. of Brooklyn.

Edward C. Panton, C.S. '14, construction engineer active in California work, including the San Francisco Bay bridge.

Lawrence M. Latz, M.E. '21, of Flushing, N. Y.

Howard B. Vannote, M.E. '22, engineer in the Brooklyn concern, the H. M. Storms Co.

Edgar C. Goodale, M.E. '23, power plant engineer recently with the Bonneville Power Administration of Vancouver, Washington.

Carl E. Stare, C.E. '29, employed in the Wisconsin Gillette Tire plant of the U.S. Rubber Co.

Harrison B. Simpson, E.E. '31, chemist and plant manager for several firms in New York, Connecticut, and Massachusetts.

James W. Macdonald

(*Continued from page 17*)

did get to sea for a while on an escort carrier.

On his return to Cornell Jim found the basketball situation just about as he had left it, and as a result was Assistant Manager last year, and will be Co-Manager this winter. He also went back down to the boat house and coxed the J.V. through their races last spring. After the Poughkeepsie Regatta, the varsity coxwain had to take an N.R.O.T.C. cruise, so Jim took the Varsity to Seattle and yelled them through that race.

Jim belongs to Delta Tau Delta Fraternity. In addition he is a member of Chi Epsilon, Aleph Semach, Sphinx Head, and several other campus organizations. While at Cornell he is trying to get as much of the Structural end of Civil Engineering as he can so as to be well prepared for his chosen job when he graduates.

As a rule Jim is an easy going boy, but has developed a strong desire to reform the entire English-speaking world on the subject of spelling his last name which is all one word and has no capital "D" in it.

Lots of luck, Jim Macdonald and let's hope your name is spelled correctly in this article!

Fabric Creation

(*Continued from page* 11)

duction. The textitle engineer watches his plans materialize as yarn passes through evolutionary stages to fabric ready for the couturier. From the knitting machine, the material is inspected and a test watch is taken out for quality analysis. Any damages are traced back to the machine causing the flaw. The machine is checked for possible causes of trouble including yarn defects, needle fatigue, or, more often, lint in a delicate mechanism. The last-named situation is the main reason for fabric damage in the knitting industry.

Finishing Process

The cloth is packaged and sent to the mill finishing department or to a contracting finisher, where the fabric will assume the final form that it possesses in the garment. The cloth is first fulled under pressure and may often be scoured afterwards. Fulling is the adding of salts that give the cloth its feel and impart to knitted cloth a freedom from curling, a troublesome phenomenon which occurs in some circularly knit fabrics. If fulling is correctly done, only an excess of chemical salts will wash out in the scouring process, the proper amount of salt remaining bonded to the fiber itself. The scouring, besides removing extra salts, cleans the fabric of all oils used in the knitting process which would prevent the dyes from taking.

A series of dyeing operations now take place which appear almost magical. Viscose and acetate rayons do not "take" the same dyes. The engineer may run the cloth of the two base fibers through a dye bath and have the acetate affected by one dye color and the viscose by another, or have one fiber of the two remain unaffected. The dye bath may be a mordant series; it may contain a non-tarnish alloy dye for the silver thread. The dyeing may be done by pressure process, vat acid dyeing, or piece dyeing, whichever method meets the particular need. Excess dye and water are extracted by pressure rolls or in a centrifugal extractor, and the damp cloth is dried in a long dryer as it moves in a wide ribbon through the plant. Other subfinishing devices are used on cloth at this point such as printing, napping, or shearing, but our white fabric needs none of these. It is steamed, made smooth, and given a subdued gloss by calenderizing it before final packing.

Manufacturing Progress

(*Continued from page* 9)

tolerance stacking, and in many cases insufficient dimensioning. This condition arises because of an oversight by the designer or perhaps insufficient knowledge of the founding and basic manufacturing methods. Hence the product designer and process planner must come to agreement as to what is required so that the functional value of the part will not be impaired. The process planner should never try to "second guess" the product designer.

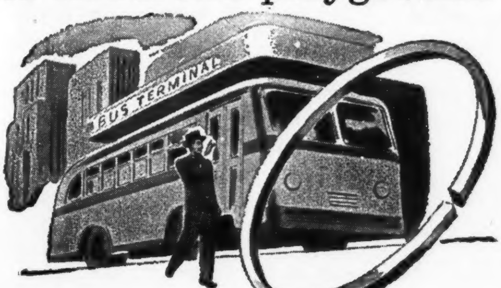
3. DETERMINE THE FOUNDING METHOD—In some cases the process planner will find that the

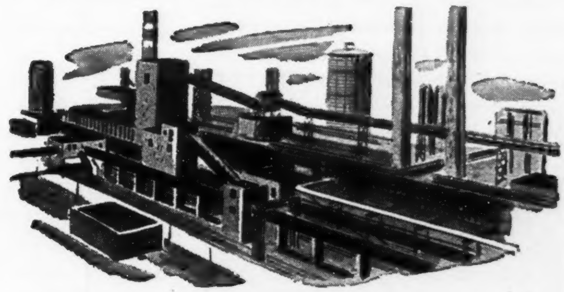
(*Continued on page* 32)

QUESTION:

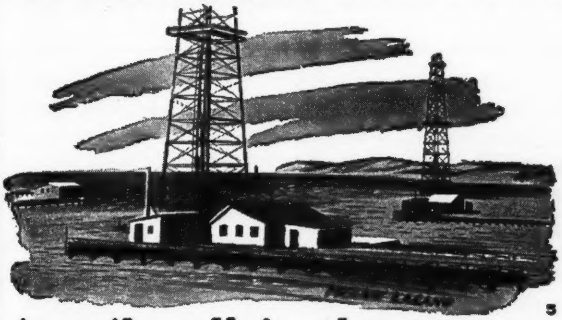
What do these things have in common?

A children's playground[1] . . . . a private pleasure plane[2] . . .





An interurban bus[3] . . . . a battery of coke ovens[4] . . .



An oil well in the ocean[5] . . . . and a deadly insecticide?[6]

ANSWER:

They've all been made more efficient by the engineering or chemical skill of Koppers

HERE'S HOW: 1. Koppers durable Tarmac surfacing for playgrounds, roads, airports. **2.** Koppers Aeromatic, variable-pitch propellers. **3.** Koppers American Hammered Piston Rings. **4.** Koppers-designed and Koppers-built coke plants. **5.** Koppers pressure-treated timber for underwater structures that must resist marine-borers. **6.** Koppers chemicals from coal for use in insecticides. All these, and many more, are Koppers products. All bear the Koppers trade-mark...the symbol of a many-sided service. Wherever you see it, it means top quality. Koppers Co., Inc., Pittsburgh 19, Pa.

K KOPPERS

Manufacturing Progress

(*Continued from page* 30)

founding method is specified on the blue print of the part; however, occasoinally only the material will be specified, so it is then necessary to determine what founding method will be most suitable in relation to subsequent basic manufacturing methods and operations. Knowledge of founding methods and basic manufacturing operations will minimize the trial paths of planning taken before finding the ideal compromise. If, for example, the founding method is casting, it will be essential that the process planner work closely with the foundry to learn the variables in the method and to make recommendations better qualifying the casting for subsequent primary and secondary manufacturing operations.

4. DETERMINE THE PRIMARY MANUFACTURING METHOD—In this step the process planner only infrequently has a difficult problem, because the founding methods can be followed only by certain manufacturing methods and operations. For instance, the primary or predominant manufacturing method to forging or casting will be productive machining with very few exceptions.

5. DETERMINE THE SECONDARY MANUFACTURING METHOD(S)—The determining of the secondary manufacturing method, if one is required, is sometimes very easy since specifications will be given for it on the part print. In other cases the manufacturing method of heat treatment may have to be included between the primary and secondary manufacturing operations. If a secondary manufacturing method were required, the productive machining process planner would have to rely upon the process planner for heat treatment manufacturing methods who, as previously stated, would use the same Thought Pattern Steps.

6. DETERMINE PRIMARY MANUFACTURING METHOD OPERATION(S)—This is an extremely important step that requires careful analysis by the process planner, since it is the first operation to be performed after the founding method. Many old timers say, "You've got to get started right out of the rough, to come out right." The primary manufacturing method operations are determined by indicators much as a doctor diagnoses a disease by symptoms. Some of the indicators used by the process planner are close tolerances, microfinished surfaces and surface relations. These indicators vary with different products.

7. DETERMINE SECONDARY MANUFACTURING METHOD OPERATION(S)—In this step the process planner is concerned with those operations which complete the sequence between the primary manufacturing method operation and the secondary manufacturing method as well as between the latter and the finished part. For certain parts the secondary manufacturing operation(s) will be completed in the same setup as the primary manufacturing methods operations. The thinking in this step follows a path of working from "known to known."

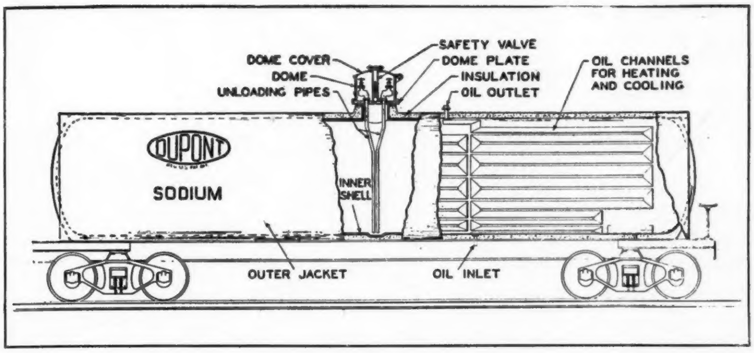
8. ACCOMPLISH PRIMARY

(*Continued on page* 34)

Du Pont *Digest*

Items of Interest to Students of Science and Engineering

Industrial Organic Applications of Metallic Sodium



Sodium for organic reactions is shipped in 80,000-lb. quantities. It is pumped into the car, solidified by cooling and melted by hot oil for removal.

There would seem to be a considerable gap between the electrolysis of salt to make sodium, and research in the field of organic chemistry. However, at Du Pont as much emphasis is placed on organic research to develop outlets for sodium as on its inorganic uses.

For more than 15 years, intensive work on industrial uses for sodium has been carried on in Du Pont laboratories and plants by chemists, physicists, chemical, mechanical and electrical engineers.

In the organic field, this research has contributed a number of important uses for sodium such as the reduction of fatty esters, particularly of natural glycerides, to alcohols.

$$C_{15}H_{31}\overset{\overset{O}{\|}}{C}{-}OR+4Na\xrightarrow[\text{solution}]{\text{alcohol}}C_{15}H_{31}CH_2OH+4RONa$$

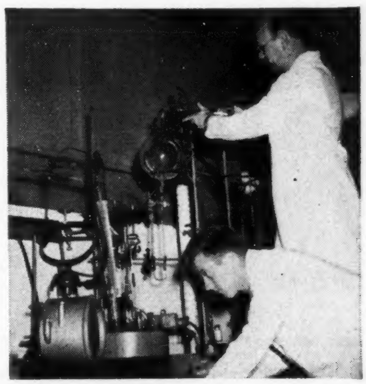
Du Pont organic chemists have found that sodium with selected secondary alcohols, such as methyl amyl alcohol, in the presence of toluene or xylene, eliminates shortcomings of the classical method involving ethyl alcohol and sodium. Practically quantitative yields of the higher molecular weight alcohols are obtained.

This new method is especially useful in preparing unsaturated alcohols not easily made by catalytic hydrogenation. The process can be carried out at atmospheric pressure and compares favorably with catalytic hydrogenation of saturated, higher fatty esters because of the simplicity of operation and equipment.

The discovery of the new reaction conditions has led to the use of millions of pounds of sodium annually for manufacture of long-chain alcohols for wetting and emulsifying agents and synthetic detergents.

Other important processes developed by Du Pont organic research include the use of sodium for reduction of fatty esters to corresponding long-chain acyloins, and reduction of nitriles to primary amines.

Du Pont has also contributed to the development of many other uses for sodium and its simple derivatives, such as in the manufacture of tetraethyllead, used in high-grade motor fuels, dyestuffs synthesis, and descaling of alloy steels. In the form of sodium hydride or sodium alkoxides, sodium is a catalyst for many Claisen condensations, useful in the manufacture of barbiturates, sulfa drugs, vitamins, keto-acids and diketones.



Preparing to carry out an organic condensation reaction involving the use of sodium, R. B. Clark, B.S., West Virginia University '42, and W. J. Hilts, M.S., Syracuse '36.

Questions College Men ask about working with Du Pont

WILL AN ADVANCED DEGREE HELP ME?

For certain types of work, particularly research and development, a higher degree is a distinct advantage and about a third of the men engaged in this work are Ph.D's. However, the majority of our technically trained men are Bachelors or Masters. Every effort is made to recognize a man's training as well as his special experience and aptitudes. Write for a copy of the new booklet, "The Du Pont Company and the College Graduate," 2521 Nemours Building, Wilmington 98, Delaware.

More facts about Du Pont—**Listen to "Cavalcade of America," Mondays, 8 P.M. EST, on NBC**

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Manufacturing Progress

(Continued from page 32)

MANUFACTURING METHOD OPERATION(S)—To accomplish the primary manufacturing operation(s) the process planner must select surfaces of registry on the work piece which will maintain a space relationship between the cutting tool and the work piece in the OX, OY and OZ directions. The 3-2-1 system of seats and surfaces of registry is generally recognized, and its application can be tested for geometric, arithmetic, and mechanical qualifications. From the tool designer's standpoint the seats of registry must control the disturbing factors of wear, dirt, deflection, and work piece variation and mutilation.

9. ACCOMPLISH SECONDARY MANUFACTURING METODHS OPERATION(S)—In many cases steps 8 and 9 will be combined; however, if step 9 is accomplished individually the approach outlined in step 8 will be followed.

10. IMPLEMENT PRIMARY AND SECONDARY MANUFACTURING METHODS OPERATIONS—In general, when the process planner has completed steps 1-9 the operational sequence is complete and the next major task is specifying machines and auxiliary equipment. The process planner must have a broad knowledge of the prime accuracy of each type of machine, the producing accuracy of each type, and the capacity. The General Motors Corporation bulletin on "Classification of Standard Machines" provides very good reference material. In some cases the operational sequence may have to be altered to permit the use of available machines, or perhaps special machines will have to be designed to meet the progress of planning. Machine builders have always been very helpful and cooperative in problems of implementation.

11. PLAN METHODS OF GAGING OR TESTING PART—In this step the process planner must set up methods of gaging or testing the work piece at various stages of completion, and in its finished state as a part or component of an assembly to determine whether or not the objectives of the manufacturing methods and operations have been attained.

The steps outlined in the *Thought Pattern* have been tried and found to be sound, but it must be understood that there are the factors of economics and human relations which may greatly affect planning.

From the presentation of the steps in the process planning thought pattern, it becomes evident that the process planner has an important sphere of influence defined by the previously discussed components of the PATTERN OF PROGRESS. (See Figure 1).

The process planner in the planning function of Process Engineering is a key man in the PATTERN OF PROGRESS. When the process planner is studying what is specified and determining what is required, he is in a position to sug-

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gest more advanced design because he knows that the other three components have progressed sufficiently to accommodate the new suggestion. Incidentally, the product designer learns how specifications should be given if the part is to be produced to meet its functional requirements. All engineers have been taught the ideal geometry, but many lack an appreciation of practical geometry. In the same step the process planner sometimes comments that if a certain type of material were available the overall process could be greatly improved. The rolling mill or the foundry is being pressed or stimulated by the process planner to keep the material component in balance. In the final analysis, the process planner in his position of coordinator is continually prodding each component of the PATTERN OF PROGRESS into new and more valuable developments for us as a society. For the student trained in the field of process engineering there are unlimited opportunities.

LETTERS TO THE EDITOR

To the Editor:

We are most impressed by an article in the CORNELL ENGINEER Volume 13, Number 1, October 1947, by H. F. Spirer entitled "The Story of the Slide Rule."

We would like very much to use it in a forthcoming issue of the U.S.I. Chemical News mailing piece.

The U.S.I. Chemical News . . . reaches approximately 10,000 key executives in the chemical and related industries . . .

Very truly yours,
Harold Prince,
G. M. Basford Company.

To the Editor:

Would you please give space in your magazine to the following note?

Finland has an excellent and keenly scientific minded Technical Institute, Teknillinen Korkeakoulu. During the war its library was bombed and totally destroyed.

On my recent trip to Finland for the American Friends Service Committee, I discussed the situation with Dr. Martti Levon, Director of the Institute. He said he would welcome gifts of Scientific and Technical Books and Periodicals from America to take the place of those destroyed. In the remarkable efforts for recovery that the Finns are making, the lack of technical library facilities is a very serious handicap. It would be a practical act of friendship to a nation that holds America in high regard if Americans should contribute good technical books and periodicals to this library.

Any such gifts should be marked for the Institute of Technology, Helsinki, and sent to the Legation of Finland, 2144 Wyoming Ave., N.E., Washington, D.C. Dr. K. T. Jutila, the Finnish Minister, will arrange for their being shipped to Finland.

Arthur E. Morgan
Member, American Friends Service Committee
Yellow Springs, Ohio.

STRESS and STRAIN...

A man was carrying a grandfather's clock down the street. He was met by a slightly inebriated gentleman. The drunk stopped, stared, and then said, "Say, buddy, why doncha carry a wrist watch?"

* * *

"You advertised in our paper for a night watchman. Did you get any results?"

Shop keeper: "I most certainly did. The advertisement appeared yesterday morning, and I was burglarized last night."

* * *

"Did you know that Jane is getting married?"

"Is that so! Who's the lucky man?"

"Her father."

* * *

An inebriate dreaded the tongue-lashing from his wife that invariably accompanied his return home in the early hours of the morning. So, after a night of tippling, he returned home, went to the kitchen, tied a rope around his waist, and fastened skillets, pots and pans to the rope in such a manner that they dragged behind him as he walked. Then he took off his shoes and crept toward his bedroom, muttering, "She'll never hear me in this infernal din."

* * *

Definition: Research — a blind man in a dark room hunting for a black cat that isn't there.

* * *

Co-ed: "You're awfully bashful, aren't you? Now look out, 'cause I'm going to scare you."

She kissed him.

"Now you try to scare me."

Ag: "Boo!"

A pilot was flying a plane containing two atom bombs when both his motors went dead. He made for the nearest airport, and radioed, "This is Smith at 20,000, two atom bombs aboard, both motors dead, what instructions?" No response. At 10,000 feet he radioed the same message again. No response. At 2,000 feet he blasted out again. This time he got a response. "Smith, this is O'Brien. Repeat after me . . . 'Our Father which art in Heaven . . .'"

* * *

"—and a dash of bitters . . ."

A married man returned home one night at a late hour and, finding difficulty with his equilibrium, made considerable noise in the hallway. Suddenly, there was a sound of crashing glass which awakened his wife.

"John," she called, "what's the matter?"

From downstairs came a low mumble, "I'll teach those goldfish to snap at me."

Freshman (leaving Baker Lab): "What's that funny smell?"

Other freshman: "That's fresh air, you dope."

* * *

A man was fumbling at his keyhole in the small hours of the morning. A policeman saw his difficulty and came to the rescue.

"Can I help you find the keyhole, sir?" he asked.

"Thash all right, old man," said the other, cheerfully, "you just hold the house still and I can manage."

* * *

Temperance Lecturer: "And in conclusion, my dear fellows, I will give you a practical demonstration of the evils of Demon Rum.

"I have two glasses here on the table: one is filled with whiskey. I will now place an angle worm in the glass of water. See how it lives, squirms, vibrates with the very spark of life.

"Now, I place a worm in the glass of whiskey. See how it curls up, writhes in agony, and finally dies. Now, young man," pointing to a student in the front row, "what moral do you get from this story?"

Student: "If you don't want worms, drink whiskey."

* * *

"Pa, what does it mean by "Diplomatic Phraseology'?"

"My son, if you tell a girl that time stands still while you look into her eyes, that's diplomacy. But, if you tell her that her face would stop a clock . . ."

* * *

Here's something handy to know: Take one cigarette out of a package. The package becomes a cigarette lighter.